NASA TECH BRIEF

Mechanical Properties of a Lap Joint Under Uniform Clamping Pressure

An understanding of the factors contributing to the nonlinearities in complex structures is important to the development of methods for more exact dynamic analysis of the structures. Interfacial slip phenomena at joints are major contributors to these nonlinear factors. A common type of joint found in aerospace structures is the lap joint. These are often fastened together with bolts or rivets, with the result that loads on the structure are transferred through the friction at the interface caused by the clamping action of the fastenings. The load is not transferred through shear in the fastenings until the loading applied to the lap is large enough to cause gross sliding over the entire interface.

Equations were derived for the load/deflection relations, the energy dissipation per cycle, and the instantaneous rate of dissipation for a lap joint idealized as two overlapping plates clamped together under a uniform clamping pressure. The energy dissipation per cycle is only valid for steady-state cyclic loading, whereas the load/deflection equations and instantaneous dissipation rate are valid for arbitrary loading and take into account the previous loading history. The differences between the instantaneous dissipation rate in a lap joint and the equivalent linear system are illustrated for cases of sinusoidal loading and triangular loading.

Note:

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